National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209
703-841-3200
Fax: 703-841-3300

BUTTON CELL BATTERY COLLECTION: WHY IT DOES NOT MAKE SENSE

JANUARY 2003

BUTTON CELL BATTERY COLLECTION: WHY IT DOES NOT MAKE SENSE

Some states and local communities have proposed collecting button cell batteries because the batteries contain mercury. This paper will discuss why such collection does not make sense.

USE OF MERCURY IN BATTERIES

At one time, battery manufacturers used small amounts of mercury to suppress the formation of internal gasses that affect all batteries containing zinc electrodes. Gassing can lead to leakage, possible rupture and/or short shelf life of batteries. The battery industry developed alternative product designs that eliminated added mercury in all batteries except button cells. In addition, the industry offered the zinc-air button cell to replace mercuric oxide button cells used primarily in hearing aids. These alternatives resulted in a decrease in mercury use of over 1,000 tons per year. The US Department of the Interior has published a chart showing this decline in the following document, http://minerals.er.usgs.gov/minerals/pubs/commodity/mercury/.

TYPES OF BUTTON BATTERIES

Button batteries are used in hearing aids, digital thermometers, insulin pumps, portable medical monitors, hospital pagers, watches, toys and calculators.

Silver oxide and alkaline manganese button cells provide a nominal 1.5 volts per cell -- zinc air button cells provide a nominal 1.4 volts per cell.

Zinc air button cells are used primarily in hearings aids. Oxygen, which reacts with the zinc electrode, is obtained from air that enters the cell from one or more holes. Because of need for continuous supply of air, zinc air batteries cannot be used in tightly sealed products. Because zinc air cells are used in hearing aids, this chemistry is the most prevalent type of button cell. Because of the number of zinc air batteries sold and the level of mercury in these cells, zinc air button cells contain over 70% of the mercury used in button cells.

Alkaline manganese and **silver oxide** button cells may be used in tightly sealed products. Common applications include watches, toys and calculators.

Lithium coin cells are similar in appearance to coins and provide a nominal 3 volts per cell. Lithium coin cells cannot be interchanged with other button cells because of their different size and different voltage. Lithium coin cells contain no mercury.

Mercuric oxide button cells use mercuric oxide as an electrode. This results in these cells containing 30-40% mercury by weight. These cells were used primarily in hearing aids. The battery industry phased out these cells between 1991-1995. Federal law enacted in 1996 bans the sale of these cells.

WHY THE BATTERY INDUSTRY USES MERCURY IN BUTTON CELLS

Beginning in the 1980s, the battery industry increased the refining of zinc to reduce impurities that lead to gassing. The large size of cylindrical and rectangular alkaline manganese batteries allows these batteries to be packed less fully and allow for some internal expansion. These and other factors prevent the buildup of internal gas pressures that cause leaking or cell rupture.

Button cells present unique problems. They are relatively small. In addition, manufacturers need to provide maximum energy in their small interiors to provide acceptable battery power and reliable performance. This results in little or no room for any internal gas buildup before it affects the button cell. Gas buildup can cause bulging that can lead to leakage and/or rupture. US federal law and the laws in many states reflect this need for mercury by allowing levels of up to 25 mg in alkaline button cells. The industry did offer the zinc-air button cell to replace the mercuric oxide button cell in hearing aides resulting in a greater than 98% reduction in mercury use per button cell.

Cumulatively, all button cells sold in the US on an annual basis contain less than 2 tons of mercury. That means the battery industry has reduced its use of mercury from over 1,000 tons per year to less than 2 tons per year. Two-thirds of the mercury in button cells is in zinc air batteries because of the large number of batteries used in hearing aids. The average mercury levels are 3 mg in silver oxide cells, 8 mg in zinc air cells and 11 mg in alkaline manganese cells. This means that only one pound of mercury is used to manufacturer 57,000 zinc air batteries.

COLLECTION OF BUTTON CELLS PRESENTS UNIQUE COST, SAFETY AND ENVIRONMENTAL PROBLEMS

A. **Collection of button cells is not cost-efficient** – Collection of button cells is not cost-efficient because there is little mercury in each cell. This results in the need to collect very large numbers of button cells to collect very little mercury. There are a wide range of distribution sources for button cells, but no established collection infrastructure. A new program would be required to collect button cells. This effort would need to be independent of established program such as the Rechargeable Battery Recycling Corporation (RBRC). Button cell collection is incompatible with the RBRC program due to concerns with contaminating the RBRC collection effort with mercury. Furthermore, there is little economic sense to collect button cells for the small amount of mercury they contain because there is no value in recovered mercury and collection costs are significant.

B. **Collection and storage can create a safety hazard** – Storing large quantities of loose, unpackaged button cells can create a safety hazard. Used button cells may still contain small amounts of energy and there is the possibility that collected batteries may be short-circuited, creating heat and in unusual cases even fires if the battery terminals remain in contact and the batteries have been mixed with flammable materials. To avoid this problem button cells would have to be stored to ensure that their terminals are not in contact increasing processing of button cells and collection costs.

In addition, storing batteries is likely to lead to an increase in battery ingestion by young and old as people retain button cells for collection. Such ingestions can, in a few situations, lead to serious injury. The Director of the National Capital Poison Control Center opposes button cell collection because of the likely increase in ingestions.

C. **Environmental costs of collection and transportation are likely to exceed the small environmental benefits –** A life cycle analysis of various collection systems conducted for the British Government shows that collecting and transporting primary batteries may have greater detrimental environmental impact than any benefits gained from recycling batteries. Available data shows that emissions of mercury from landfills are small. The EPA Mercury Report to Congress estimates that landfill emissions of mercury from all sources are less than 0.1 tons nationwide. An estimate of mercury emissions from Florida landfills conducted with the Florida DEP concluded that landfills contribute less than 1% of manmade sources of mercury emissions. Finally, the 2002 New Jersey Mercury Report came to the following conclusion: "Low concentration of mercury in landfill gas…argues that no efforts to control this source are necessary at this time." Data also shows that incinerators are no longer a major source of emissions. A 2002 EPA memo shows mercury emissions from incinerators declined in the US from 42 tons in 1990 to 2 tons in 2000. This would be less than 2% of all manmade sources of mercury emissions in the US.

SUMMARY

- The battery industry has virtually eliminated the use of added mercury.
- For performance and safety reasons, button cells require very small amounts of added mercury.
- Collection is not cost-efficient.
- Collection can cause safety hazards.
- Collection can cause more environmental harm than any benefit that might result.
- No country or US state requires only button cell collection.

NEMA

The Dry Battery Section of the National Electrical Manufacturers Association (NEMA) is the trade association of United States manufacturers of dry cell batteries. Members of the NEMA Dry Battery Section (http://www.nema.org/drybattery/) include:

.

Duracell, Inc.
Eastman Kodak Company
Eveready Battery Company, Inc.
Panasonic Industrial Company
Polaroid Corporation
Rayovac Corporation
Renata SA
Saft, Inc.
Wilson Greatbatch, Ltd.

For additional information, contact:

NEMA
1300 North 17th Avenue, Suite 1847
Rosslyn, Virginia 22209
Telephone: (703) 841-3200
Fax: (703) 841-3300
Website: www.nema.org